General

Guideline Title

ACR Appropriateness Criteria® rib fractures.

Bibliographic Source(s)

Henry TS, Kirsch J, Kanne JP, Chung JH, Donnelly EF, Ginsburg ME, Heitkamp DE, Kazerooni EA, Ketai LH, McComb BL, Parker JA, Ravenel JG, Restrepo CS, Saleh AG, Shah RD, Steiner RM, Suh RD, Mohammed TLH, Expert Panel on Thoracic Imaging. ACR Appropriateness CriteriaÂ® rib fractures [online publication]. Reston (VA): American College of Radiology (ACR); 2014. 8 p. [34 references]

Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: Mohammed TL, Kirsch J, Amorosa JK, Brown K, Chung JH, Dyer DS, Ginsburg ME, Heitkamp DE, Kanne JP, Kazerooni EA, Ketai LH, Parker JA, Ravenel JG, Saleh AG, Shah RD, Expert Panel on Thoracic Imaging. ACR Appropriateness Criteria® rib fractures. [online publication]. Reston (VA): American College of Radiology (ACR); 2011. 4 p. [20 references]

Recommendations

Major Recommendations

ACR Appropriateness Criteria®

Clinical Condition: Rib Fracture

Variant 1: Adult. Suspected rib fractures from minor blunt trauma (injury confined to ribs).

Radiologic Procedure	Rating	Comments	RRL*
X-ray chest	8	Obtain PA view.	☢
X-ray rib views	5		☢☢☢
CT chest without contrast	3		☢☢☢
Tc-99m bone scan whole body	2		☢☢☢
CT chest with contrast	1		☢☢☢
CT chest without and with contrast	1		☢☢☢
US chest	1		O

Radiologic Procedure	Rating	Comments	RRL*
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 2: Adult. Suspected rib fractures after CPR.

Radiologic Procedure	Rating	Comments	RRL*
X-ray chest	8		☢
X-ray rib views	5		☢☢☢
CT chest without contrast	5		☢☢☢
CT chest with contrast	2		☢☢☢
Tc-99m bone scan whole body	2		☢☢☢
US chest	2		O
CT chest without and with contrast	1		☢☢☢
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 3: Rib pain. Suspected stress fracture.

Radiologic Procedure	Rating	Comments	RRL*
X-ray chest	7	Obtain PA view.	☢
X-ray rib views	5		☢☢☢
CT chest without contrast	3		☢☢☢
Tc-99m bone scan whole body	3		☢☢☢
CT chest with contrast	2		☢☢☢
CT chest without and with contrast	1		☢☢☢
US chest	1		O
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 4: Adult. Suspected pathologic rib fracture.

Radiologic Procedure	Rating	Comments	RRL*
X-ray chest	8	Obtain PA view.	☢
CT chest without contrast	7		☢☢☢
Tc-99m bone scan whole body	7		☢☢☢
X-ray rib views	5		☢☢☢
FDG-PET/CT skull base to mid-thigh	5		☢☢☢☢
CT chest with contrast	2		☢☢☢

Radiologic Procedure	Rating	Comments	RRL*
CT chest without and with contrast			
US chest	1		O
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Summary of Literature Review

Introduction/Background

Rib fracture is the most common thoracic injury and is present in 10% of all traumatic injuries and in almost 40% of patients who sustain severe non-penetrating trauma. Rib fractures typically affect the fifth through ninth ribs. This may be due to the fact that the shoulder girdle affords relative protection to the upper ribs and the lower ribs are relatively mobile and may deflect before fracturing. Although rib fractures can produce significant morbidity, the diagnosis of associated complications (such as pneumothorax, hemothorax, pulmonary contusion, atelectasis, flail chest, cardiovascular injury, and injuries to solid and hollow abdominal organs) may have a more significant clinical impact. When isolated, rib fractures have a relatively low morbidity and mortality.

Overview of Imaging Modalities

Neither clinical examination nor radiography is ideal for the diagnosis of rib fractures. The standard posteroanterior (PA) chest radiograph is specific but not very sensitive for fractures (the supine anteroposterior [AP] radiograph is even less sensitive), and clinical examination is sensitive but not specific. Rib detail radiographs rarely add additional information to the PA film that would change treatment. Similarly, dual-energy chest radiography with bone subtraction imaging has failed to show improved detection when compared with standard radiographs. A review of 39 patients with a total of 204 rib fractures showed no statistically significant difference in sensitivity, specificity, or level of confidence between standard images and dual-energy subtraction images.

Multidetector computed tomography (CT) is increasingly used as the method of choice for the radiologic evaluation of the traumatized patient. It provides an accurate assessment of fractures and associated internal injuries. CT also provides an accurate means of assessing cartilage fractures, which are typically missed on radiography. However, CT is not usually performed only to evaluate for the presence of rib fractures; rather, it is used to evaluate for other associated complications of trauma. Ultrasound (US) may also be used for depiction of rib fractures or associated costal cartilage injury in the emergency setting as described below, although it is a time-consuming examination.

Nuclear medicine bone scans are sensitive but not specific for detection of rib fracture. Bone scans are most commonly used for detection of osseous involvement in systemic processes (e.g., metastatic disease) and may result in false-positive diagnosis of malignancy in a patient with rib fractures, although the pattern of tracer uptake can often help differentiate the 2 processes. Bone scans have limited use in distinguishing acute and subacute/chronic rib fractures as they will usually be positive within 24 hours after an injury, but the return to normal can be slow (79% by 1 year, 93% by 2 years, and 100% in 3 years). Furthermore, patients with known malignancy and benign rib fractures may exhibit false-positive findings on fluorine-18-2-fluoro-2-deoxy-D-glucose positron emission tomography (FDG-PET) studies performed 17 days to 8 weeks after injury.

Discussion of Imaging Modalities by Variant

Suspected Rib Fracture after Minor Blunt Trauma (Injury Confined to Ribs)

This variant refers to rib fractures resulting from minor blunt trauma. For severe cases of trauma please refer to the National Guideline Clearinghouse (NGC) summary of the American College of Radiology (ACR) Appropriateness Criteria® blunt chest trauma - suspected aortic injury.

In combination with the physical examination, a standard PA chest radiograph should be the initial diagnostic test for detection of rib fractures. Despite the low sensitivity of the chest radiograph, which may miss 50% of rib fractures, studies suggest that failure to detect fractures does not necessarily alter patient management or outcome in uncomplicated cases. A review of 271 patients who presented to a community hospital emergency department after minor trauma showed no difference in treatment (use of pain medications, etc.) between patients who did and did not have rib fractures diagnosed on physical examination or radiographs. In a study of 552 patients who had blunt chest trauma and resultant rib fracture (diagnosed on clinical or radiographic grounds), 93% of affected patients ultimately resumed daily activities without significant disability. The chest radiograph may detect complications that are more important than the rib fractures themselves such as pneumothorax, hemothorax, flail chest, or contusion. Although a flail chest can usually be diagnosed at physical examination, it is conceivable that in a heavy patient a flail chest could be missed by clinical examination, but a chest radiograph almost always shows the displaced fragments.

CT is more sensitive than radiography for the detection of rib fractures, although it is usually used for assessment of associated injuries in the setting of severe trauma. Postprocessing techniques such as volume-rendered display and multiplanar images may depict rib fractures with high accuracy and may provide a more time-efficient method of evaluation compared to the sequential evaluation of numerous axial images, although a recent retrospective review revealed that at least 17% of rib fractures from blunt trauma (mostly nondisplaced or buckle fractures) were missed on CT even with coronal imaging. Multiplanar or 3-dimensional (3-D) image processing may require a second console or workstation.

The increased sensitivity of CT for the detection of rib fractures does not necessarily alter the management or clinical outcomes of patients without associated injuries. A group of researchers reported that CT detected rib fractures in 66 of 589 patients (11%) who had initial chest radiographs interpreted as normal at a level I trauma center, but none of the rib fractures were considered of major clinical significance. The presence and number of rib fractures do carry prognostic significance, and detection of rib fractures may be indicated under certain circumstances. An outcomes analysis by another group of authors reviewed 388 patients with rib fractures who underwent both chest radiography (AP, supine) and chest CT and correlated the presence of rib fractures with pulmonary morbidity and mortality. They reported that although rib fractures were detected on only 46% of patients' initial chest radiographs, the presence of rib fractures and/or underlying parenchymal abnormality on radiography was associated with increased pulmonary morbidity (odds ratio, 3.8) compared with fractures only detected by CT.

Rib fractures are associated with pulmonary complications including atelectasis, impaired clearance of secretions, pneumonia, and adult respiratory distress syndrome. Increased number of rib fractures has been shown to directly correlate with increasing morbidity and mortality, and this effect is greater in patients 65 or older, many of whom have additional comorbid conditions that contribute to poor cardiopulmonary reserve. Treatment of rib fractures is generally aimed at pain control and avoidance of respiratory distress and intubation, but the presence of multiple rib fractures, in an elderly patient especially, may warrant transfer from a community hospital to tertiary care center.

Patients with rib fractures from a high-energy mechanism or with a high clinical suspicion of intrathoracic or intra-abdominal injury may warrant further evaluation such as contrast-enhanced CT, whereas a low-energy injury or normal physical examination may obviate further testing. In one study with 69 patients with nonthreatening trauma (stable vital signs with no evidence of cardiac injury, solid or hollow viscus rupture, or fractures associated with significant blood loss), it was found that neither rib studies nor chest radiographs were of clinical benefit in this scenario, but the authors concluded that clinical evidence of a complicated injury such as pneumothorax, hemothorax, or flail chest may warrant further evaluation.

Similarly, a group of researchers studied patients with lower rib fractures (ribs 7–12) and found that the negative predictive value of a negative physical examination for abdominal injury due to low-energy impact was 100%, but in patients with multiple injuries lower rib fractures were associated with abdominal organ injury in 67% of patients. Another group found no association between right-sided lower rib fractures in 55 trauma patients with hepatic injury when matched with 55 trauma patients without hepatic injury (there was a slight negative association of hepatic laceration with left-sided fractures) but ultimately concluded that the absence of rib fractures could not rule out hepatic injury. Thus, in patients with multiple injuries and lower rib fractures, contrast-enhanced CT might be indicated even in the setting of a normal clinical examination.

Several studies have demonstrated a high prevalence of radiographically-detected rib fractures in patients with aortic injury, although the positive predictive value is low. In a large prospective multicenter trial involving 50 trauma centers in North America, a group of authors reported multiple rib fractures in 46% of 274 patients with blunt aortic injury. Another study found fractures of ribs 1–4 in 18% of 41 patients with traumatic aortic injury proved by angiography but a positive predictive value of only 20% to 21%. Another group of researchers studied 548 patients who underwent angiography to evaluate for aortic injury and concluded that rib fractures were the only type of thoracic skeletal injury that had a higher incidence in patients with aortic injury (58%) versus those without aortic injury (43%), but the positive predictive value was only 14.8%. This has also been shown at autopsy, where 530 motor vehicle fatalities were retrospectively reviewed. In 90 victims, 105 aortic injuries were found, and 78% had multiple rib fractures, including 42% with fractures of the first rib.

There is some evidence that rib fractures detected with CT (given the increased sensitivity) may not be associated with an increased risk of aortic injury. A review of 185 patients with rib fractures detected on spine CT found no association between presence of first-rib or second-rib fracture and the incidence of aortic injury on subsequent CT; however; ribs 3–12 were not assessed. Increased likelihood of injury to the adjacent subclavian and innominate vessels has been reported with displaced first-rib and second-rib fractures, but this injury can usually be suspected on clinical grounds or from a chest radiograph.

Several articles have noted that US can detect fractures not seen on conventional radiographs. One study compared sonography and radiography (chest radiography plus one oblique rib radiograph) in 50 patients and found that radiographs detected only 8 of 83 (10%) sonographically detected rib fractures and were positive in only 6 of the 39 patients who had demonstrated fractures. In this study, sonography allowed evaluation of the costochondral junction, the costal cartilage, and the ribs and was able to show nondisplaced fractures. Another study found rib fractures in 40.5% of 37 patients with minor blunt chest trauma and negative radiographs by using US; osseous fractures were more common in the elderly, and duration of pain was significantly longer in these patients compared to those with chondral injuries. However, another group of researchers found US to be only marginally superior to conventional radiographs, and its routine use was not indicated due to the lengthy time of the examination, averaging 13 minutes in this series, and patient discomfort from the pressure of the US probe, particularly since identification of the fracture was unlikely to impact patient care.

Suspected Rib Fractures after Cardiopulmonary Resuscitation (CPR)

Multiple studies have shown that rib fractures are underreported on radiography performed following cardiopulmonary resuscitation (CPR). In a retrospective analysis of 40 patients who survived CPR, it was reported that CT detected rib fractures in 26 patients (65%), whereas AP chest radiography detected fractures in only 10 of the patients. These fractures are more commonly anterior, on the left side, and are more numerous in the elderly. The diagnosis of such fractures in CPR survivors may be important since approximately half of CPR survivors with rib fractures experience complications, and the presence of rib fractures in these patients may impair ventilation and compromise recovery. It should be noted that many of these patients are examined with portable supine radiography, which may contribute to underdiagnosis.

Suspected "Stress" Rib Fractures

Stress fractures are uncommon in the ribs but can result from repetitive contraction of chest wall muscles or the diaphragm at the point that it attaches to the ribs. This is most commonly caused by chronic cough (especially in women) but has also been reported in athletes who perform repetitive motion (e.g., weightlifters, pitchers, and rowers). Nuclear scintigraphy and chest CT may be used to diagnose these injuries. Although scintigraphic findings are nonspecific, CT may demonstrate the fracture, fracture-related osteosclerosis or osteolysis, or callus formation. More importantly, metastatic or primary neoplasia may be successfully excluded.

Suspected Pathologic Fracture

Pathologic fractures may result from metabolic disorders or neoplasm, including primary bone tumor, metastatic disease of intrathoracic or extrathoracic primary, hematologic malignancy (e.g., multiple myeloma, lymphoma), or direct extension of a tumor in the thorax. A PA chest radiograph may be sufficient for diagnosis of a pathologic fracture (or provide clues to an underlying diagnosis), but further evaluation using such modalities as CT, bone scan, or FDG-PET may be necessary to further characterize a lesion detected on radiography or to search for radiographically occult lesions. For further evaluation of pathologic fractures from metastatic disease, please see the NGC summary of the ACR Appropriateness Criteria® metastatic bone disease.

Summary

- It is usually unnecessary to perform dedicated rib radiography (in addition to chest radiography) for the diagnosis of fractures in adults after minor trauma.
- Although the diagnosis of multiple fractures has prognostic implications, there is no evidence that performing dedicated rib studies, CT, or bone scintigraphy is beneficial, except in the setting where such evaluation is necessary for establishing further care or other investigations (e.g., elder abuse, legal documentation).
- CT, skeletal scintigraphy and US may be helpful in evaluating selected patients with occult "stress" fractures and in evaluating selected CPR survivors or in situations in which identifying a rib fracture is deemed to be clinically important.

Abbreviations

- CPR, cardiopulmonary resuscitation
- CT, computed tomography
- FDG-PET, fluorine-18-2-fluoro-2-deoxy-D-glucose positron emission tomography
- PA, posteroanterior
- Tc-99m, technetium-99 metastable
- US, ultrasound

Relative Radiation Level Designations

Relative Radiation Level*	Adult Effective Dose Estimate Range	Pediatric Effective Dose Estimate Range
O	0 mSv	0 mSv
☢	<0.1 mSv	<0.03 mSv
☢☢	0.1-1 mSv	0.03-0.3 mSv
☢☢☢	1-10 mSv	0.3-3 mSv
☢☢☢☢	10-30 mSv	3-10 mSv

Relative Radiation Level*	Adult Effective Dose Estimate Range	Pediatric Effective Dose Estimate Range
☢☢☢☢☢	30-100 mSv	10-30 mSv
*RRL assignments for some of the examinations cannot be made, because the actual patient doses in these procedures vary as a function of a number of factors (e.g., region of the body exposed to ionizing radiation, the imaging guidance that is used). The RRLs for these examinations are designated as "Varies."		

Clinical Algorithm(s)

Algorithms were not developed from criteria guidelines.

Scope

Disease/Condition(s)

Rib fractures

Guideline Category

Diagnosis

Evaluation

Clinical Specialty

Emergency Medicine

Family Practice

Geriatrics

Internal Medicine

Nuclear Medicine

Pulmonary Medicine

Radiology

Thoracic Surgery

Intended Users

Health Plans

Hospitals

Managed Care Organizations

Physicians

Utilization Management

Guideline Objective(s)

To evaluate the appropriateness of initial radiologic examinations for patients with possible rib fractures

Target Population

Patients with possible rib fractures

Interventions and Practices Considered

1. X-ray chest or rib views
2. Computed tomography (CT) chest
    - Without contrast
    - With contrast
    - Without and with contrast
3. Technetium-99 metastable (Tc-99m) bone scan whole body
4. Ultrasound (US) chest
5. Fluorine-18-2-fluoro-2-deoxy-D-glucose positron emission tomography (FDG-PET)/CT skull base to mid-thigh

Major Outcomes Considered

- Utility of radiologic procedures in diagnosis and evaluation of rib fractures
- Sensitivity, specificity, and predictive value of radiologic procedures in diagnosis and evaluation of rib fractures

Methodology

Methods Used to Collect/Select the Evidence

Searches of Electronic Databases

Description of Methods Used to Collect/Select the Evidence

Literature Search Procedure

Staff search in PubMed only for peer reviewed medical literature for routine searches. Any article or guideline may be used by the author in the narrative but those materials may have been identified outside of the routine literature search process.

The Medline literature search is based on keywords provided by the topic author. The two general classes of keywords are those related to the condition (e.g., ankle pain, fever) and those that describe the diagnostic or therapeutic intervention of interest (e.g., mammography, MRI).

The search terms and parameters are manipulated to produce the most relevant, current evidence to address the American College of Radiology Appropriateness Criteria (ACR AC) topic being reviewed or developed. Combining the clinical conditions and diagnostic modalities or therapeutic procedures narrows the search to be relevant to the topic. Exploding the term "diagnostic imaging" captures relevant results for diagnostic topics.

The following criteria/limits are used in the searches.

1. Articles that have abstracts available and are concerned with humans.
2. Restrict the search to the year prior to the last topic update or in some cases the author of the topic may specify which year range to use in the search. For new topics, the year range is restricted to the last 10 years unless the topic author provides other instructions.
3. May restrict the search to Adults only or Pediatrics only.
4. Articles consisting of only summaries or case reports are often excluded from final results.

The search strategy may be revised to improve the output as needed.

Number of Source Documents

The total number of source documents identified as the result of the literature search is not known.

Methods Used to Assess the Quality and Strength of the Evidence

Weighting According to a Rating Scheme (Scheme Given)

Rating Scheme for the Strength of the Evidence

Study Quality Category Definitions

Category 1 - The study is well-designed and accounts for common biases.

Category 2 - The study is moderately well-designed and accounts for most common biases.

Category 3 - There are important study design limitations.

Category 4 - The study is not useful as primary evidence. The article may not be a clinical study or the study design is invalid, or conclusions are based on expert consensus. For example:

a. The study does not meet the criteria for or is not a hypothesis-based clinical study (e.g., a book chapter or case report or case series description.
b. The study may synthesize and draw conclusions about several studies such as a literature review article or book chapter but is not primary evidence.
c. The study is an expert opinion or consensus document.

Methods Used to Analyze the Evidence

Systematic Review with Evidence Tables

Description of the Methods Used to Analyze the Evidence

The topic author drafts or revises the narrative text summarizing the evidence found in the literature. American College of Radiology (ACR) staff draft an evidence table based on the analysis of the selected literature. These tables rate the strength of the evidence (study quality) for each article included in the narrative text.

The expert panel reviews the narrative text, evidence table, and the supporting literature for each of the topic-variant combinations and assigns an appropriateness rating for each procedure listed in the table. Each individual panel member assigns a rating based on his/her interpretation of the available evidence.

More information about the evidence table development process can be found in the ACR Appropriateness Criteria® Evidence Table Development document (see the "Availability of Companion Documents" field).

Methods Used to Formulate the Recommendations

Expert Consensus (Delphi)

Description of Methods Used to Formulate the Recommendations

Rating Appropriateness

The appropriateness ratings for each of the procedures included in the Appropriateness Criteria topics are determined using a modified Delphi methodology. A series of surveys are conducted to elicit each panelist's expert interpretation of the evidence, based on the available data, regarding the appropriateness of an imaging or therapeutic procedure for a specific clinical scenario. American College of Radiology (ACR) staff distribute surveys to the panelists along with the evidence table and narrative. Each panelist interprets the available evidence and rates each procedure. The surveys are completed by panelists without consulting other panelists. The appropriateness rating scale is an ordinal scale that uses integers from 1 to 9 grouped into three categories: 1, 2, or 3 are in the category "usually not appropriate"; 4, 5, or 6 are in the category "may be appropriate"; and 7, 8, or 9 are in the category "usually appropriate." Each panel member assigns one rating for each procedure for a clinical scenario. The ratings assigned by each panel member are presented in a table displaying the frequency distribution of the ratings without identifying which members provided any particular rating.

If consensus is reached, the median rating is assigned as the panel's final recommendation/rating. Consensus is defined as eighty percent (80%) agreement within a rating category. A maximum of three rounds may be conducted to reach consensus. Consensus among the panel members must be achieved to determine the final rating for each procedure.

If consensus is not reached, the panel is convened by conference call. The strengths and weaknesses of each imaging procedure that has not reached consensus are discussed and a final rating is proposed. If the panelists on the call agree, the rating is proposed as the panel's consensus. The document is circulated to all the panelists to make the final determination. If consensus cannot be reached on the call or when the document is circulated, "No consensus" appears in the rating column and the reasons for this decision are added to the comment sections.

This modified Delphi method enables each panelist to express individual interpretations of the evidence and his or her expert opinion without excessive influence from fellow panelists in a simple, standardized and economical process. A more detailed explanation of the complete process can be found in additional methodology documents found on the ACR Web site (see also the "Availability of Companion Documents" field).

Rating Scheme for the Strength of the Recommendations

Not applicable

Cost Analysis

A formal cost analysis was not performed and published cost analyses were not reviewed.

Method of Guideline Validation

Internal Peer Review

Description of Method of Guideline Validation

Criteria developed by the Expert Panels are reviewed by the American College of Radiology (ACR) Committee on Appropriateness Criteria.

Evidence Supporting the Recommendations

Type of Evidence Supporting the Recommendations

The recommendations are based on analysis of the current literature and expert panel consensus.

Benefits/Harms of Implementing the Guideline Recommendations

Potential Benefits

Selection of appropriate radiologic imaging procedures for evaluation of patients with rib fractures

Potential Harms

- Nuclear medicine bone scans may result in false-positive diagnosis of malignancy in patients with rib fractures.
- Patients with known malignancy and benign rib fractures may exhibit false-positive findings on fluorine-18-2-fluoro-2-deoxy-D-glucose positron emission tomography (FDG-PET) studies performed 17 days to 8 weeks after injury.

Relative Radiation Level

Potential adverse health effects associated with radiation exposure are an important factor to consider when selecting the appropriate imaging procedure. Because there is a wide range of radiation exposures associated with different diagnostic procedures, a relative radiation level (RRL) indication has been included for each imaging examination. The RRLs are based on effective dose, which is a radiation dose quantity that is used to estimate population total radiation risk associated with an imaging procedure. Patients in the pediatric age group are at inherently higher risk from exposure, both because of organ sensitivity and longer life expectancy (relevant to the long latency that appears to accompany radiation exposure). For these reasons, the RRL dose estimate ranges for pediatric examinations are lower as compared to those specified for adults. Additional information regarding radiation dose assessment for imaging examinations can be found in the American College of Radiology (ACR) Appropriateness Criteria® Radiation Dose Assessment Introduction document (see the "Availability of Companion Documents" field).

Qualifying Statements

Qualifying Statements

The American College of Radiology (ACR) Committee on Appropriateness Criteria and its expert panels have developed criteria for determining appropriate imaging examinations for diagnosis and treatment of specified medical condition(s). These criteria are intended to guide radiologists, radiation oncologists, and referring physicians in making decisions regarding radiologic imaging and treatment. Generally, the complexity and severity of a patient's clinical condition should dictate the selection of appropriate imaging procedures or treatments. Only those examinations generally used for evaluation of the patient's condition are ranked. Other imaging studies necessary to evaluate other co-existent diseases or other medical consequences of this condition are not considered in this document. The availability of equipment or personnel may influence the selection of appropriate imaging procedures or treatments. Imaging techniques classified as investigational by the U.S. Food and Drug Administration (FDA) have not been considered in developing these criteria; however, study of new equipment and applications should be encouraged. The ultimate decision regarding the appropriateness of any specific radiologic examination or treatment must be made by the referring physician and radiologist in light of all the circumstances presented in an individual examination.

Implementation of the Guideline

Description of Implementation Strategy

An implementation strategy was not provided.

Institute of Medicine (IOM) National Healthcare Quality Report Categories

IOM Care Need

Getting Better

IOM Domain

Effectiveness

Identifying Information and Availability

Bibliographic Source(s)

Henry TS, Kirsch J, Kanne JP, Chung JH, Donnelly EF, Ginsburg ME, Heitkamp DE, Kazerooni EA, Ketai LH, McComb BL, Parker JA, Ravenel JG, Restrepo CS, Saleh AG, Shah RD, Steiner RM, Suh RD, Mohammed TLH, Expert Panel on Thoracic Imaging. ACR Appropriateness CriteriaÂ® rib fractures [online publication]. Reston (VA): American College of Radiology (ACR); 2014. 8 p. [34 references]

Adaptation

Not applicable: The guideline was not adapted from another source.

Date Released

1995 (revised 2014)

Guideline Developer(s)

American College of Radiology - Medical Specialty Society

Source(s) of Funding

The American College of Radiology (ACR) provided the funding and the resources for these ACR Appropriateness Criteria®.

Guideline Committee

Committee on Appropriateness Criteria, Expert Panel on Thoracic Imaging

Composition of Group That Authored the Guideline

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Financial Disclosures/Conflicts of Interest

Not stated

Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: Mohammed TL, Kirsch J, Amorosa JK, Brown K, Chung JH, Dyer DS, Ginsburg ME, Heitkamp DE, Kanne JP, Kazerooni EA, Ketai LH, Parker JA, Ravenel JG, Saleh AG, Shah RD, Expert Panel on Thoracic Imaging. ACR Appropriateness Criteria® rib fractures. [online publication]. Reston (VA): American College of Radiology (ACR); 2011. 4 p. [20 references]

Guideline Availability

Electronic copies: Available from the American College of Radiology (ACR) Web site.

Print copies: Available from the American College of Radiology, 1891 Preston White Drive, Reston, VA 20191. Telephone: (703) 648-8900.

Availability of Companion Documents

The following are available:

- ACR Appropriateness Criteria®. Overview. Reston (VA): American College of Radiology; 2013 Nov. 3 p. Electronic copies: Available from the American College of Radiology (ACR) Web site.
- ACR Appropriateness Criteria®. Literature search process. Reston (VA): American College of Radiology; 2013 Apr. 1 p. Electronic copies: Available from the ACR Web site.
- ACR Appropriateness Criteria®. Evidence table development – diagnostic studies. Reston (VA): American College of Radiology; 2013 Nov. 3 p. Electronic copies: Available from the ACR Web site.
- ACR Appropriateness Criteria®. Radiation dose assessment introduction. Reston (VA): American College of Radiology; 2103 Nov. 3 p. Electronic copies: Available from the ACR Web site.
- ACR Appropriateness Criteria®. Manual on contrast media. Reston (VA): American College of Radiology; 90 p. Electronic copies: Available from the ACR Web site.
- ACR Appropriateness Criteria®. Procedure information. Reston (VA): American College of Radiology; 1 p. Electronic copies: Available from the ACR Web site.
- ACR Appropriateness Criteria® rib fractures. Evidence table. Reston (VA): American College of Radiology; 2014. 12 p. Electronic copies: Available from the ACR Web site.

Patient Resources

None available

NGC Status

This NGC summary was completed by ECRI on March 6, 2006. This summary was updated by ECRI Institute on July 23, 2009, February 29, 2012, and July 31, 2014.

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